



- ☐ Tentative Specification  
☐ Preliminary Specification  
☒ Approval Specification

# MODEL NO.: V290BJ1

## SUFFIX: L01

Customer:

APPROVED BY

SIGNATURE

Name / Title

Note

Please return 1 copy for your confirmation with your signature and comments.

| Approved By     | Checked By   | Prepared By |
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**REVISION HISTORY**

| Version          | Date         | Page(New) | Section | Description                                  |
|------------------|--------------|-----------|---------|----------------------------------------------|
| Ver. 2.0         | May.15, 2012 | All       | All     | The approval specification was first issued. |
| www.panelook.com |              |           |         |                                              |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V290BJ1-L01 is a 29" TFT Liquid Crystal Display module with 3U-CCFL Backlight unit and 1ch-LVDS interface.

This module supports 1366 x 768 HDTV format and can display 16.7M colors (8-bit).

### 1.2 FEATURES

- High brightness (300 nits)
- High contrast ratio (2500:1)
- Fast response time (Gray to gray average 8.5 ms)
- High color saturation (NTSC 72%)
- HDTV (1366 x 768 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Optimized response time for 50/60 Hz frame rate
- Ultra wide viewing angle : Super MVA technology
- RoHS compliance

### 1.3 APPLICATION

- Standard Living Room TVs.
- Public Display Application.
- Home Theater Application.
- MFM Application.

### 1.4 GENERAL SPECIFICATIONS

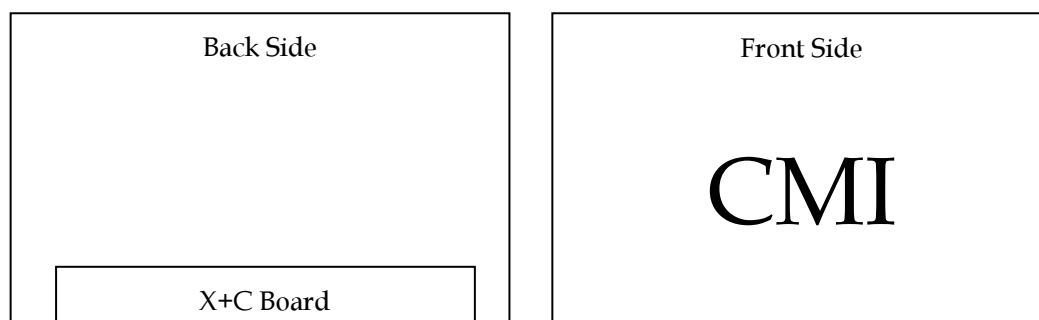
| Item                   | Specification                            | Unit  | Note |
|------------------------|------------------------------------------|-------|------|
| Active Area            | 631.092 (H) x 354.816 (V) (29" diagonal) | mm    | (1)  |
| Bezel Opening Area     | 635 (H) x 358.8 (V)                      | mm    |      |
| Driver Element         | a-si TFT active matrix                   | -     | -    |
| Pixel Number           | 1366 x R.G.B. x 768                      | pixel | -    |
| Pixel Pitch(Sub Pixel) | 0.154 (H) x 0.462 (V)                    | mm    | -    |
| Pixel Arrangement      | RGB Vertical Stripe                      | -     | -    |
| Display Colors         | 16.7M                                    | color | -    |
| Display Operation Mode | Transmissive mode / Normally black       | -     | -    |
| Surface Treatment      | Anti-Glare coating (Haze 3.5%)           | -     | (2)  |
| Rotation Function      | Unachievable                             |       | (3)  |
| Display Orientation    | Signal input with "CMI"                  |       | (3)  |

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) The spec. of the surface treatment is temporarily for this phase. CMI reserves the rights to change this feature.



Note (3)



**1.5 MECHANICAL SPECIFICATIONS**

| Item        |                | Min.  | Typ.  | Max.  | Unit | Note     |
|-------------|----------------|-------|-------|-------|------|----------|
| Module Size | Horizontal (H) | 653.8 | 654.8 | 655.8 | mm   | (1), (2) |
|             | Vertical (V)   | 379.7 | 380.7 | 381.7 | mm   |          |
|             | Depth (D)      | 44    | 45    | 46    | mm   |          |
| Weight      |                | —     | 3064  | —     | —    | —        |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module Depth is between bezel to rear.

**2. ABSOLUTE MAXIMUM RATINGS**
**2.1 ABSOLUTE RATINGS OF ENVIRONMENT**

| Item                          | Symbol | Value |      | Unit | Note     |
|-------------------------------|--------|-------|------|------|----------|
|                               |        | Min.  | Max. |      |          |
| Storage Temperature           | TST    | -20   | +60  | °C   | (1)      |
| Operating Ambient Temperature | TOP    | 0     | 50   | °C   | (1), (2) |
| Shock (Non-Operating)         | SNOP   | —     | 50   | G    | (3), (5) |
| Vibration (Non-Operating)     | VNOP   | —     | 1.0  | G    | (4), (5) |

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ( $T_a \leq 40\text{ }^{\circ}\text{C}$ ).

(b) Wet-bulb temperature should be  $39\text{ }^{\circ}\text{C}$  Max. ( $T_a > 40\text{ }^{\circ}\text{C}$ ).

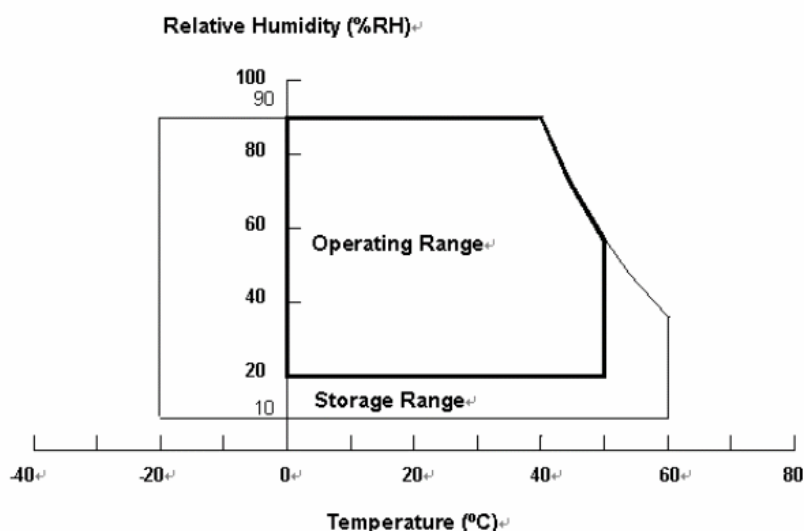
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to  $65\text{ }^{\circ}\text{C}$  with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over  $65\text{ }^{\circ}\text{C}$ . The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.





**2.2 PACKAGE STORAGE**

When storing modules as spares for a long time, the following precaution is necessary.

- (a) Do not leave the module in high temperature, and high humidity for a long time, It is highly recommended to store the module with temperature from 0 to 35 °C at normal humidity without condensation.
- (b) The module shall be stroed in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

**2.3 ELECTRICAL ABSOLUTE RATINGS****2.3.1 TFT LCD MODULE**

| Item                 | Symbol | Value |      | Unit | Note |
|----------------------|--------|-------|------|------|------|
|                      |        | Min.  | Max. |      |      |
| Power Supply Voltage | VCC    | -0.3  | 13.5 | V    | (1)  |
| Logic Input Voltage  | VIN    | -0.3  | 3.6  | V    |      |

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD MODULE

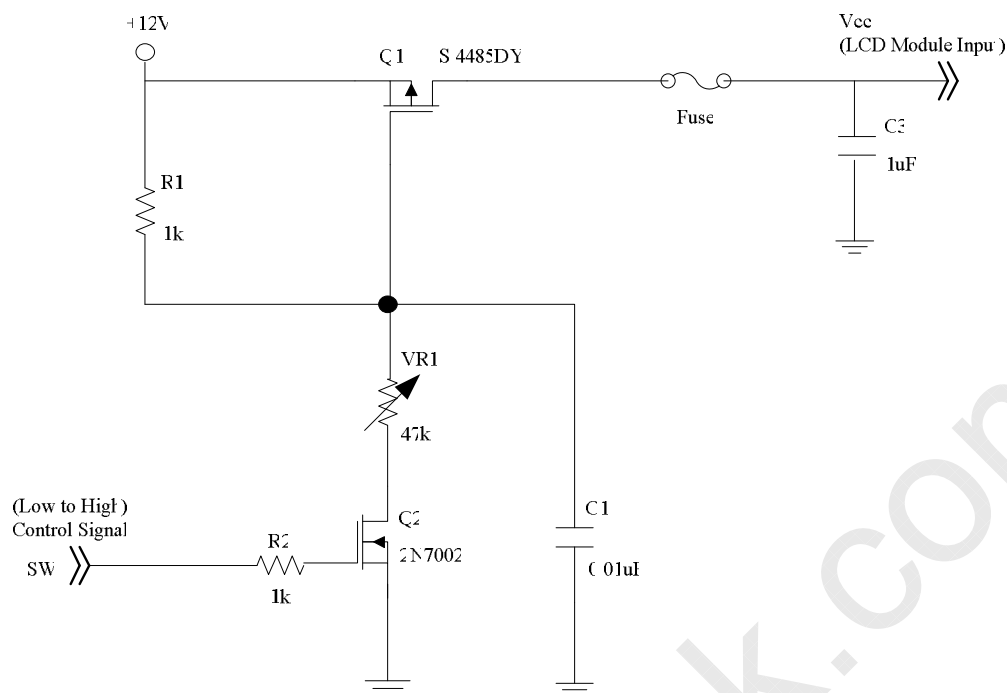
(Ta = 25 ± 2 °C)

| Parameter            |                                           | Symbol            | Value |      |      | Unit | Note |
|----------------------|-------------------------------------------|-------------------|-------|------|------|------|------|
|                      |                                           |                   | Min.  | Typ. | Max. |      |      |
| Power Supply Voltage |                                           | V <sub>CC</sub>   | 10.8  | 12   | 13.2 | V    | (1)  |
| Rush Current         |                                           | I <sub>RUSH</sub> | —     | —    | 3.9  | A    | (2)  |
| Power consumption    | White Pattern                             | P <sub>T</sub>    | —     | 5.04 | 6.72 | W    | (3)  |
|                      | Black Pattern                             | P <sub>T</sub>    | —     | 3.12 | 4.32 |      |      |
|                      | Horizontal Stripe                         | P <sub>T</sub>    | —     | 5.28 | 6.96 |      |      |
| Power Supply Current | White Pattern                             | P <sub>T</sub>    | —     | 0.42 | 0.56 | A    |      |
|                      | Black Pattern                             | P <sub>T</sub>    | —     | 0.26 | 0.36 |      |      |
|                      | Horizontal Stripe                         | P <sub>T</sub>    | —     | 0.44 | 0.58 |      |      |
| LVDS interface       | Differential Input High Threshold Voltage | V <sub>LVTH</sub> | +100  | —    | +300 | mV   | (4)  |
|                      | Differential Input Low Threshold Voltage  | V <sub>LVTL</sub> | -300  | —    | -100 | mV   |      |
|                      | Common Input Voltage                      | V <sub>CM</sub>   | 1.0   | 1.2  | 1.4  | V    |      |
|                      | Differential input voltage (single-end)   | V <sub>ID</sub>   | 200   | —    | 600  | mV   |      |
|                      | Terminating Resistor                      | R <sub>T</sub>    | —     | 100  | —    | ohm  |      |
| CMOS interface       | Input High Threshold Voltage              | V <sub>IH</sub>   | 2.7   | —    | 3.3  | V    |      |
|                      | Input Low Threshold Voltage               | V <sub>IL</sub>   | 0     | —    | 0.7  | V    |      |

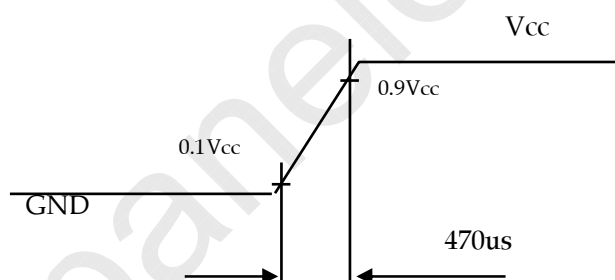
Note (1) The module should be always operated within the above ranges.

The ripple voltage should be controlled under 10% of V<sub>CC</sub> (Typ.).

Note (2) Measurement condition :

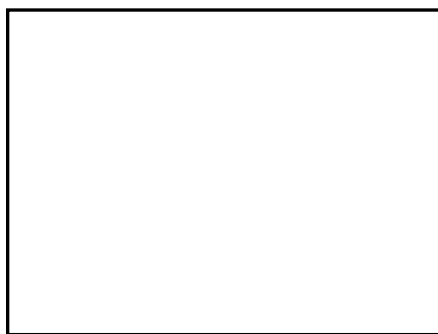


Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at  $V_{cc} = 12\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



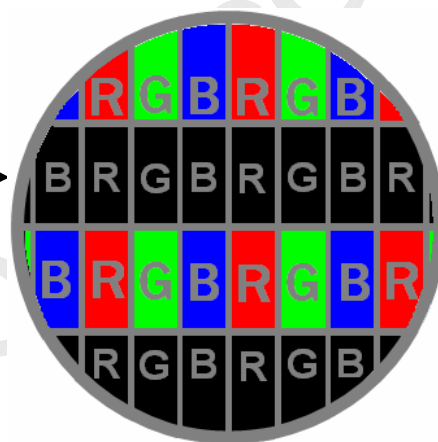
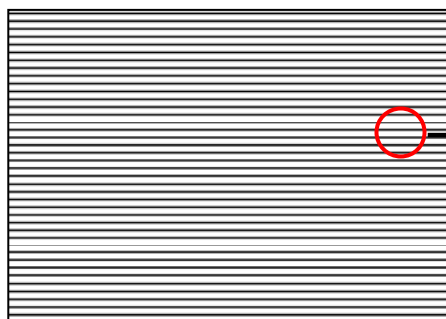
Active Area

b. Black Pattern

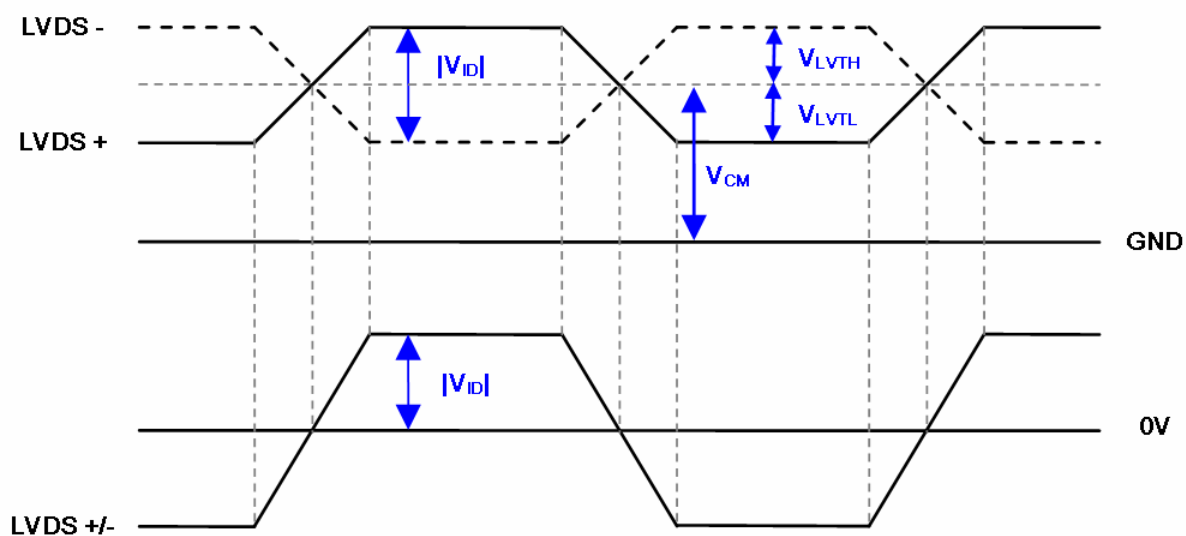


Active Area

c. Horizontal Pattern



Note (4) The LVDS input characteristics are as follows :



### 3.2 BACKLIGHT UNIT

#### 3.2.1 LAMP SPECIFICATION

The backlight unit contains 3 U- type CCFL ( $T_a = 25 \pm 2^\circ\text{C}$ )

| Parameter            | Symbol          | Value            |            |                  | Unit                     | Note                               |
|----------------------|-----------------|------------------|------------|------------------|--------------------------|------------------------------------|
|                      |                 | Min.             | Typ.       | Max.             |                          |                                    |
| Lamp Input Voltage   | VL              |                  | 1270       |                  | $V_{\text{RMS}}$         | $I_L=15\text{ mA}$                 |
| Lamp Current         | IL              | 14.5             | 15         | 15.5             | $\text{mA}_{\text{RMS}}$ | (1)                                |
| Lamp Turn On Voltage | VS              | —                | —          | 2420             | $V_{\text{RMS}}$         | $T_a = 0^\circ\text{C}$<br>(2)(3)  |
|                      |                 | —                | —          | 2020             | $V_{\text{RMS}}$         | $T_a = 25^\circ\text{C}$<br>(2)(3) |
| Operating Frequency  | FL              | 30               | —          | 80               | KHz                      | (4)                                |
| Lamp Life Time       | LBL             | 50000            | —          | —                | Hrs                      | (5)                                |
| Power Consumption    | $P_{\text{BL}}$ |                  | 60         |                  | W                        | (5)                                |
| Unsymmetrical ratio  | UR              |                  |            | 10%              |                          | (6)                                |
| Crest factor         | C.F.            | $\sqrt{2} -10\%$ | $\sqrt{2}$ | $\sqrt{2} +10\%$ |                          | (6)                                |

Note (1) Lamp current is measured by utilizing AC current probe and its value is average by measuring master and slave board.

Note (2) The lamp starting voltage VS should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

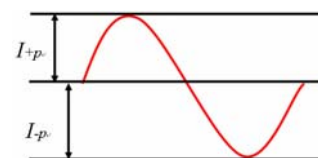
Note (3) In order to turn on the lamp correctly, the input voltage should be higher than the maximum lamp turn on voltage at  $0^\circ\text{C}$ . The maximum input voltage of inverter is suggested should be lower than 3000 volts.

Note (4) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

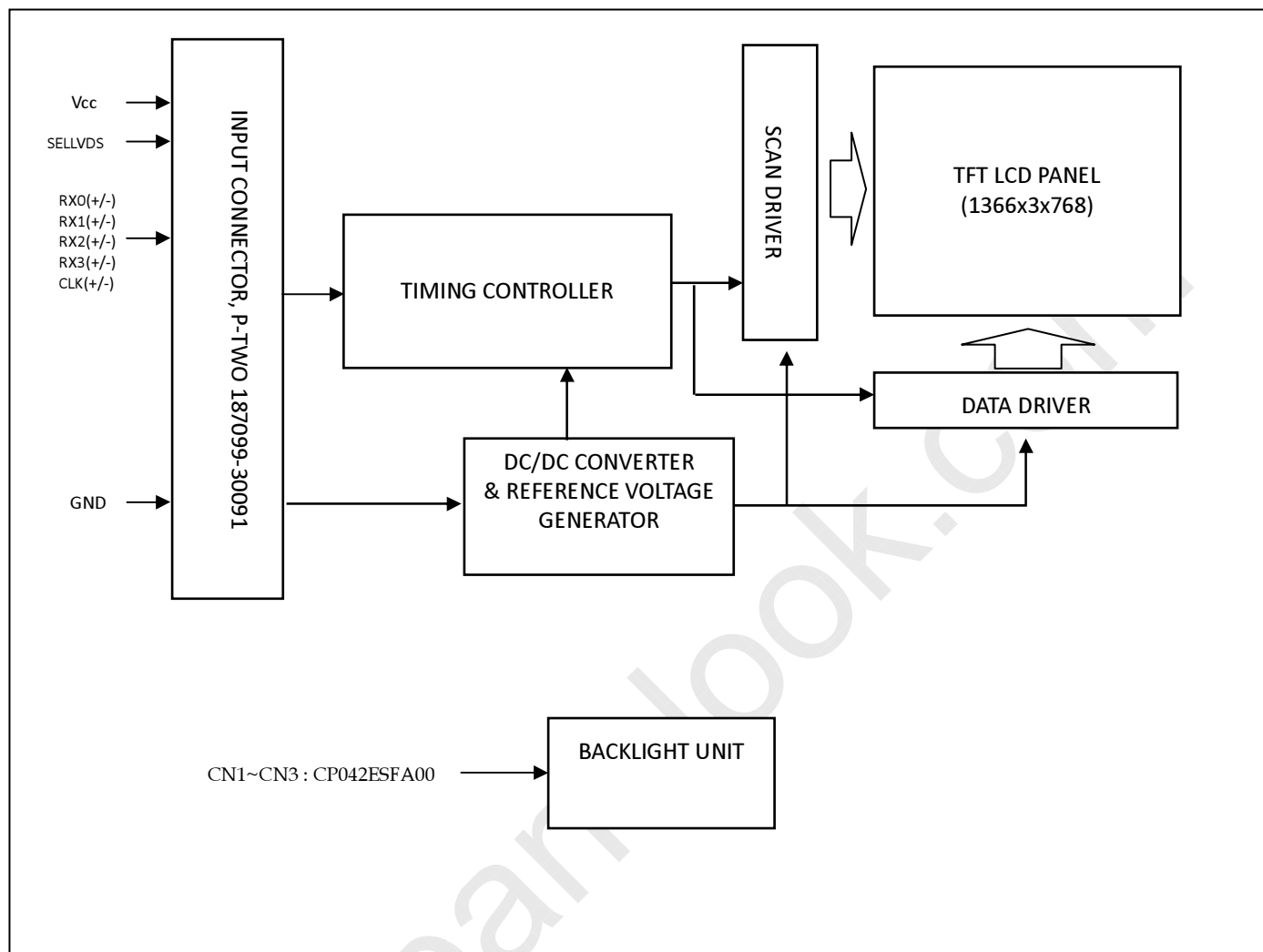
Note (5) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_L = 15\text{ mA}_{\text{RMS}}$ .

Note (6) Unsymmetrical ratio =  $|I_{+p} - I_{-p}| / I_{\text{rms}} * 100\%$

Crest factor =  $I_{+p}$  (or  $I_{-p}$ ) /  $I_{\text{rms}}$



Please light on the lamp with symmetric waveform, both voltage & current.

**4. BLOCK DIAGRAM OF INTERFACE****4.1 TFT LCD MODULE**

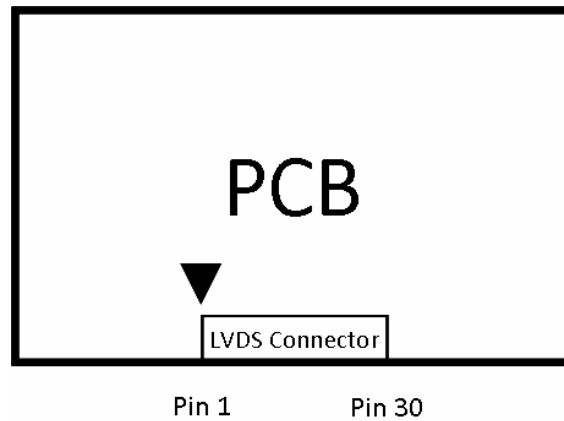
**5. INPUT TERMINAL PIN ASSIGNMENT****5.1 TFT LCD Module Input**

CNF1 Connector Pin Assignment (P-TWO 187099-30091)

| Pin | Name    | Description                           | Note   |
|-----|---------|---------------------------------------|--------|
| 1   | VCC     | Power supply: +12V                    |        |
| 2   | VCC     | Power supply: +12V                    |        |
| 3   | VCC     | Power supply: +12V                    |        |
| 4   | VCC     | Power supply: +12V                    |        |
| 5   | GND     | Ground                                |        |
| 6   | GND     | Ground                                |        |
| 7   | GND     | Ground                                |        |
| 8   | NC      | No connection                         | (2)    |
| 9   | SELLVDS | LVDS data format Selection            | (3)(4) |
| 10  | NC      | No connection                         | (2)    |
| 11  | GND     | Ground                                |        |
| 12  | RX0-    | Negative transmission data of pixel 0 |        |
| 13  | RX0+    | Positive transmission data of pixel 0 |        |
| 14  | GND     | Ground                                |        |
| 15  | RX1-    | Negative transmission data of pixel 1 |        |
| 16  | RX1+    | Positive transmission data of pixel 1 |        |
| 17  | GND     | Ground                                |        |
| 18  | RX2-    | Negative transmission data of pixel 2 |        |
| 19  | RX2+    | Positive transmission data of pixel 2 |        |
| 20  | GND     | Ground                                |        |
| 21  | RXCLK-  | Negative of clock                     |        |
| 22  | RXCLK+  | Positive of clock                     |        |
| 23  | GND     | Ground                                |        |
| 24  | RX3-    | Negative transmission data of pixel 3 |        |
| 25  | RX3+    | Positive transmission data of pixel 3 |        |
| 26  | GND     | Ground                                |        |
| 27  | NC      | No connection                         | (2)    |
| 28  | NC      | No connection                         | (2)    |
| 29  | NC      | No connection                         | (2)    |
| 30  | GND     | Ground                                |        |

Note (1) Connector type: P-TWO 187099-30091

LVDS connector pin order defined as follows



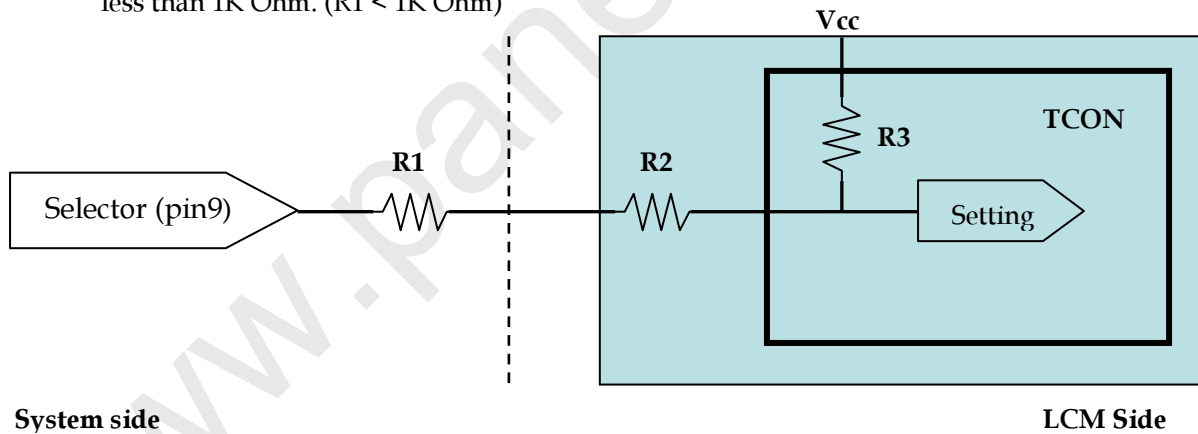
Note (2) Reserved for internal use. Please leave it open.

Note (3) Connect to Open or +3.3V: VESA Format, connect to GND: JEIDA Format.

| SELLVDS    | Mode  |
|------------|-------|
| H(default) | VESA  |
| L          | JEIDA |

L: Connect to GND, H: Connect to +3.3V

Note (4) LVDS signal pin connected to the LCM side has the following diagram. R1 in the system side should be less than 1K Ohm. ( $R1 < 1K \text{ Ohm}$ )





**5.2 BACKLIGHT UNIT**

The pin configuration for the housing and the leader wire is shown in following table.

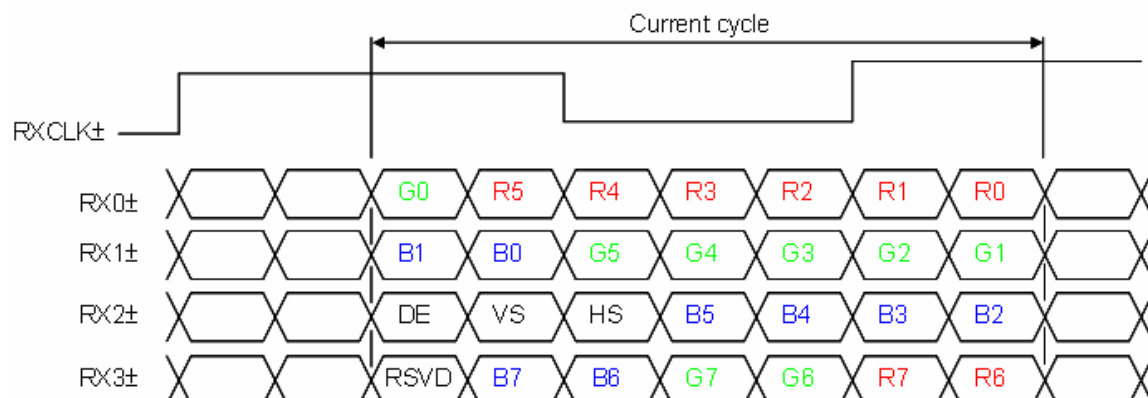
| Pin | Name | Description  | Wire Color |
|-----|------|--------------|------------|
| 1   | HV   | High Voltage | PINK       |
| 2   | HV   | High Voltage | WHITE      |

Note (1) The backlight interface housing for high voltage side is a model CP042ESFA00, manufactured by Cvilux. The mating header on inverter part number is CP042ESFA00 (Cvilux)

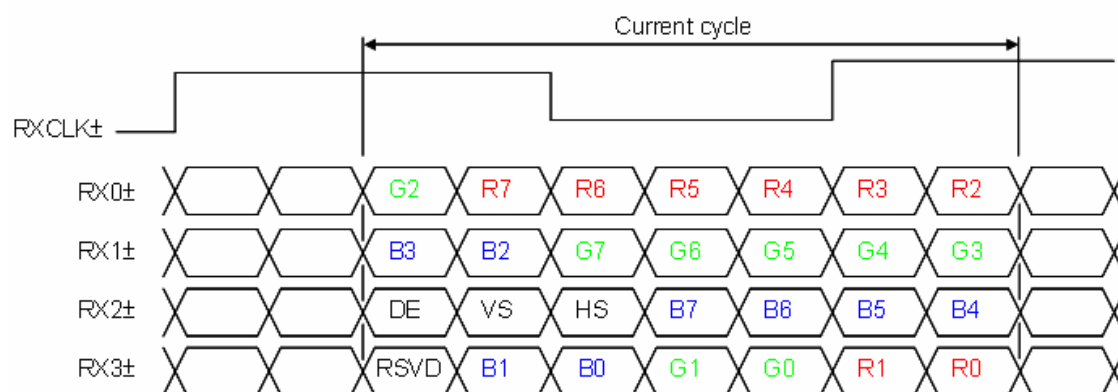


## 5.3 LVDS INTERFACE

VESA LVDS format : (SELLVDS pin=H/Open)



JEDIA LVDS format : (SELLVDS pin=L)



|       |                               |      |                    |
|-------|-------------------------------|------|--------------------|
| R0~R7 | Pixel R Data (7; MSB, 0; LSB) | DE   | Data enable signal |
| G0~G7 | Pixel G Data (7; MSB, 0; LSB) | DCLK | Data clock signal  |
| B0~B7 | Pixel B Data (7; MSB, 0; LSB) |      |                    |

Note (1) RSVD (reserved) pins on the transmitter shall be "H" or "L".

**5.4 COLOR DATA INPUT ASSIGNMENT**

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color.

The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

| Color               |                  | Data Signal |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    |
|---------------------|------------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
|                     |                  | Red         |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    | Blue |    |    |    |    |    |    |    |
|                     |                  | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7    | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7   | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors        | Black            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Gray Scale Of Red   | Red (0) / Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (1)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (2)          | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Red (253)        | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (254)        | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (255)        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Green | Green (0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Green (253)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (254)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (255)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Blue  | Blue (0) / Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue (1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
|                     | Blue (2)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Blue (253)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 0  | 1  |
|                     | Blue (254)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|                     | Blue (255)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

(Ta = 25 ± 2 °C)

The input signal timing specifications are shown as the following table and timing diagram.

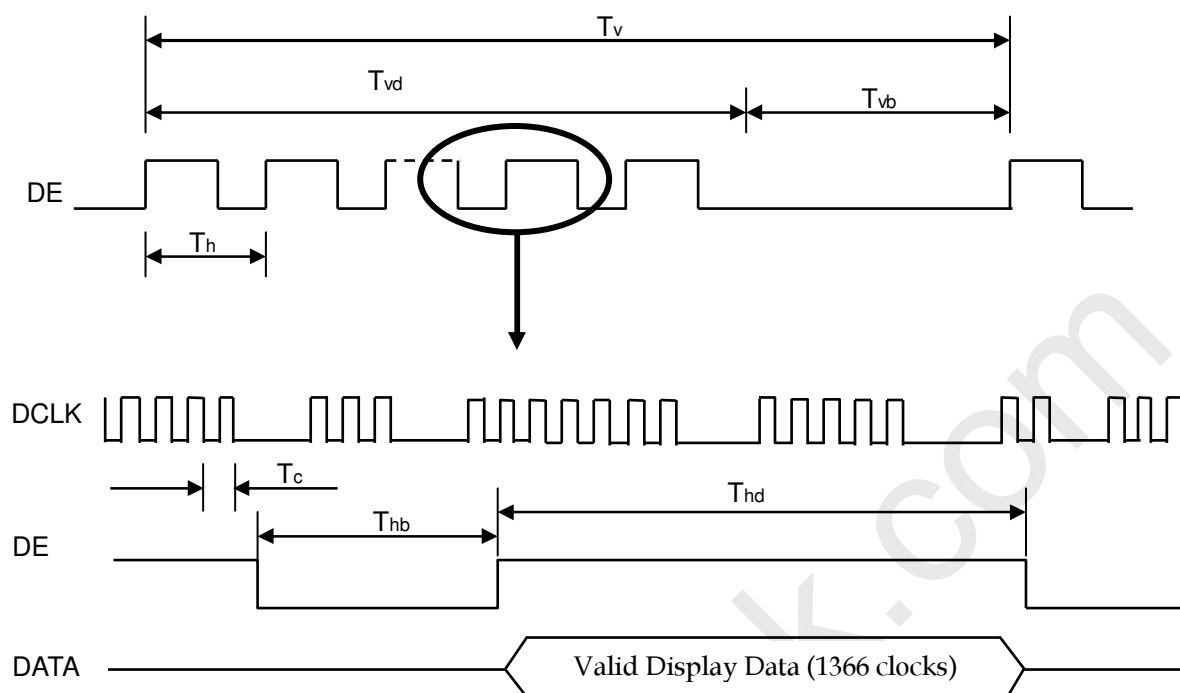
| Signal                         | Item                                 | Symbol                 | Min.            | Typ. | Max.            | Unit | Note                |
|--------------------------------|--------------------------------------|------------------------|-----------------|------|-----------------|------|---------------------|
| LVDS Receiver Clock            | Frequency                            | $F_{clkin}$<br>(=1/TC) | 60              | 76   | 82              | MHz  |                     |
|                                | Input cycle to cycle jitter          | $T_{rcl}$              | -               | —    | 200             | ps   | (3)                 |
|                                | Spread spectrum modulation range     | $F_{clkin\_mod}$       | $F_{clkin}-2\%$ | —    | $F_{clkin}+2\%$ | MHz  | (4)                 |
|                                | Spread spectrum modulation frequency | $F_{SSM}$              | —               | —    | 200             | KHz  |                     |
| LVDS Receiver Data             | Receiver Skew Margin                 |                        |                 |      |                 | ps   | (5)                 |
| Vertical Active Display Term   | Frame Rate                           | $F_{r5}$               | 47              | 50   | 53              | Hz   | (6)                 |
|                                |                                      | $F_{r6}$               | 57              | 60   | 63              | Hz   |                     |
|                                | Total                                | $T_v$                  | 778             | 806  | 986             | Th   | $T_v=T_{vd}+T_{vb}$ |
|                                | Display                              | $T_{vd}$               | 768             | 768  | 768             | Th   | —                   |
|                                | Blank                                | $T_{vb}$               | 10              | 38   | 218             | Th   | —                   |
| Horizontal Active Display Term | Total                                | $T_h$                  | 1446            | 1560 | 1936            | Tc   | $T_h=T_{hd}+T_{hb}$ |
|                                | Display                              | $T_{hd}$               | 1366            | 1366 | 1366            | Tc   | —                   |
|                                | Blank                                | $T_{hb}$               | 80              | 194  | 570             | Tc   | —                   |

Note (1) Please make sure the range of pixel clock has follow the below equation :

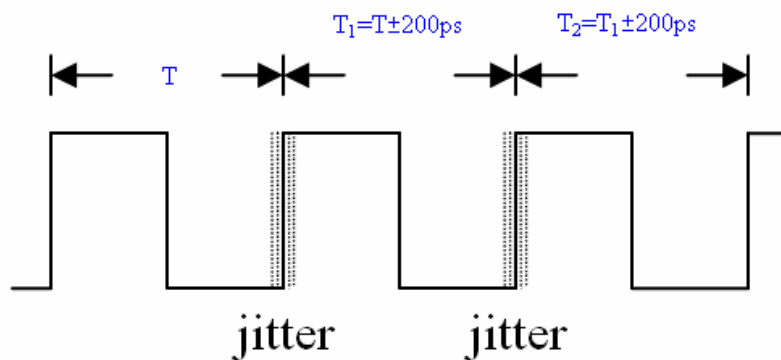
$$F_{clkin(max)} \geq F_{r6} \times T_v \times T_h$$

$$F_{r5} \times T_v \times T_h \geq F_{clkin(min)}$$

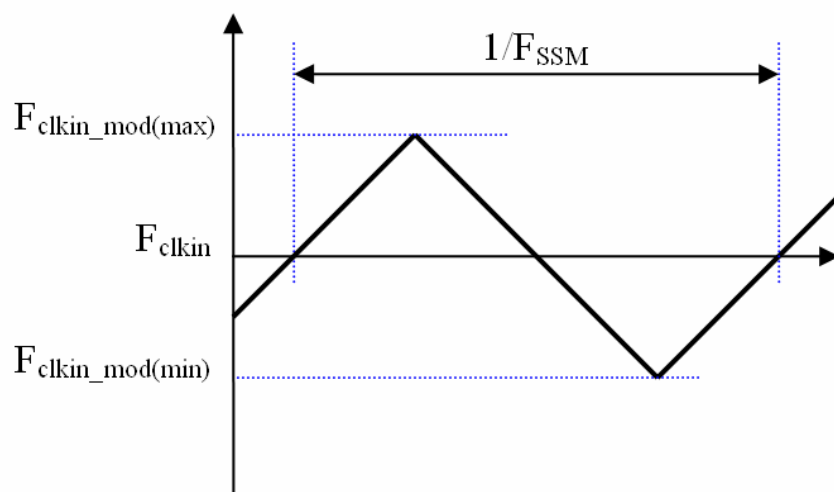
Note (2) This module is operated in DE only mode and please follow the input signal timing diagram below :



Note (3) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T_1 - T|$

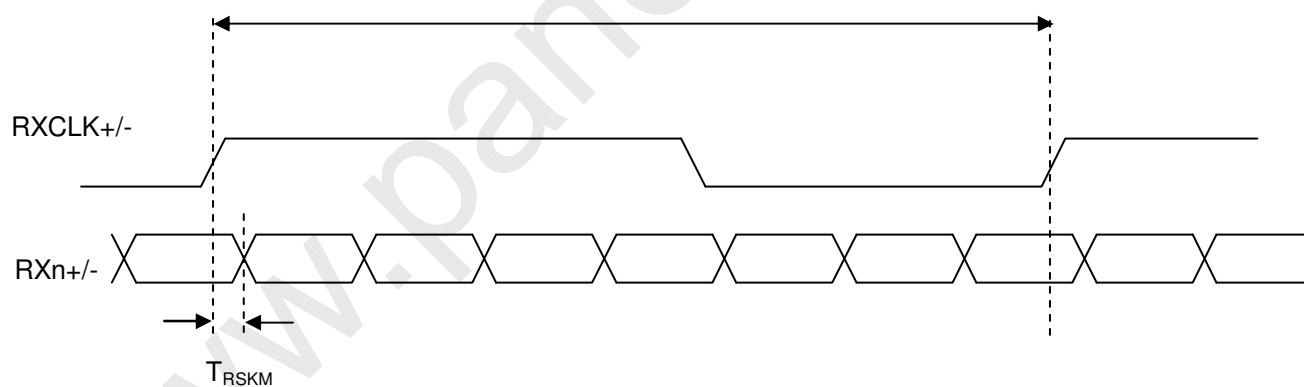


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

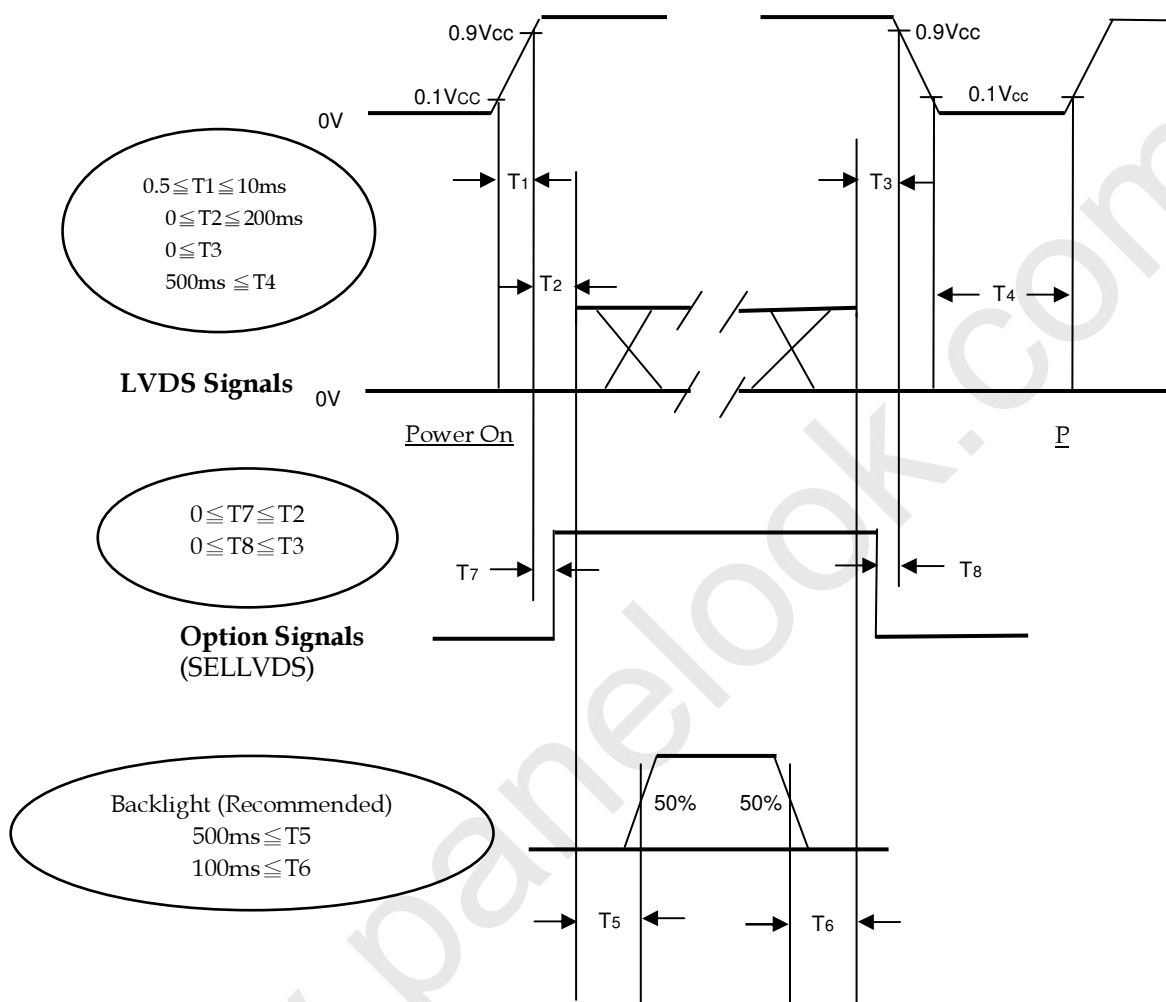
#### LVDS RECEIVER INTERFACE TIMING DIAGRAM



## 6.2 POWER ON/OFF SEQUENCE

( $T_a = 25 \pm 2^\circ\text{C}$ )

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of V<sub>CC</sub>.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of V<sub>CC</sub> is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T<sub>4</sub> should be measured after the module has been fully discharged between power off and on period.

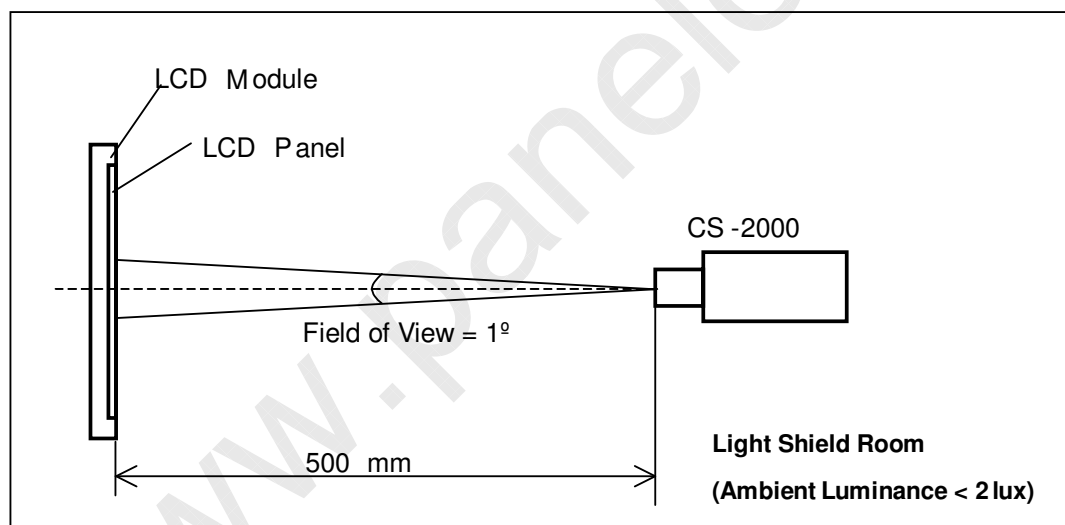
Note (5) Interface signal shall not be kept at high impedance when the power is on.

**7. OPTICAL CHARACTERISTICS****7.1 TEST CONDITIONS**

| Item                             | Symbol                                                        | Value | Unit |
|----------------------------------|---------------------------------------------------------------|-------|------|
| Ambient Temperature              | Ta                                                            | 25±2  | oC   |
| Ambient Humidity                 | Ha                                                            | 50±10 | %RH  |
| Supply Voltage                   | VCC                                                           | 12    | V    |
| Input Signal                     | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |       |      |
| Lamp Current                     | IL                                                            | 15    | mA   |
| Oscillating Frequency (Inverter) | FW                                                            | 58    | KHz  |
| Vertical Frame Rate              | Fr                                                            | 60    | Hz   |

Note : No guarantee level of water flow

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.





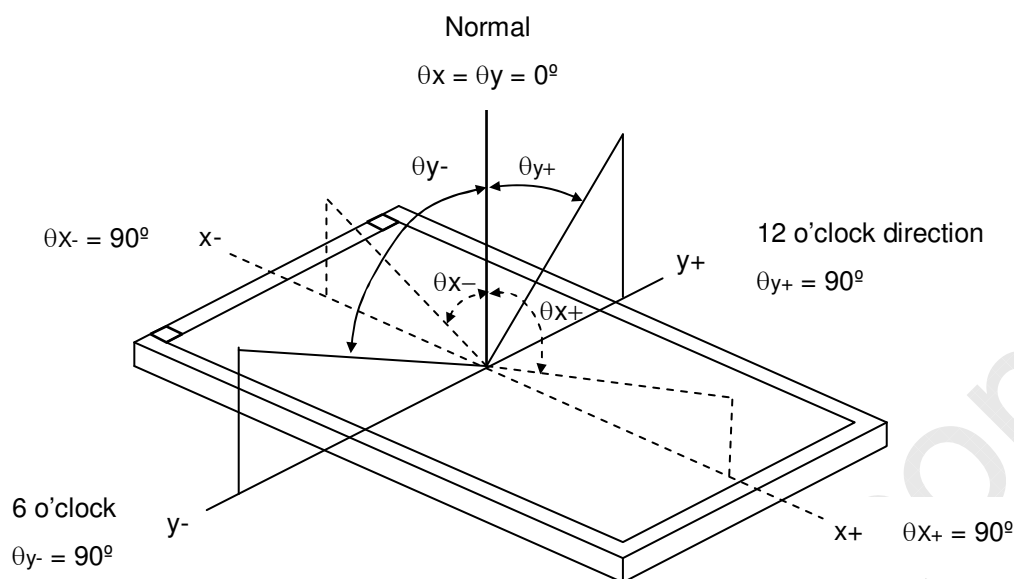
## 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in 7.1.

| Item                      |             | Symbol        | Condition                                                                    | Min.          | Typ.  | Max.          | Unit              | Note     |
|---------------------------|-------------|---------------|------------------------------------------------------------------------------|---------------|-------|---------------|-------------------|----------|
| Contrast Ratio            |             | CR            | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing angle<br>at normal direction | 1800          | 2500  |               | -                 | Note (2) |
| Response Time             |             | Gray to gray  |                                                                              |               | 8.5   | 16            | ms                | Note (3) |
| Center Luminance of White |             | LC            |                                                                              |               | 300   |               | cd/m <sup>2</sup> | Note (4) |
| White Variation           |             | $\delta W$    |                                                                              |               |       | 1.4           | -                 | Note (6) |
| Cross Talk                |             | CT            |                                                                              |               |       | 4             | %                 | Note (5) |
| Color Chromaticity        | Red         | Rx            |                                                                              | Typ.<br>-0.03 | 0.643 | Typ.<br>+0.03 | -                 |          |
|                           |             | Ry            |                                                                              |               | 0.332 |               | -                 |          |
|                           | Green       | Gx            |                                                                              |               | 0.275 |               | -                 |          |
|                           |             | Gy            |                                                                              |               | 0.604 |               | -                 |          |
|                           | Blue        | Bx            |                                                                              |               | 0.144 |               | -                 |          |
|                           |             | By            |                                                                              |               | 0.062 |               | -                 |          |
|                           | White       | Wx            |                                                                              |               | 0.280 |               | -                 |          |
|                           |             | Wy            |                                                                              |               | 0.290 |               | -                 |          |
|                           | Color Gamut | C.G           |                                                                              |               |       |               | 72                |          |
| Viewing Angle             | Horizontal  | $\theta_{x+}$ |                                                                              | CR $\geq$ 20  | 80    | 88            | -                 | Deg.     |
|                           |             | $\theta_{x-}$ | 80                                                                           |               | 88    | -             |                   |          |
|                           | Vertical    | $\theta_{Y+}$ | 80                                                                           |               | 88    | -             |                   |          |
|                           |             | $\theta_{Y-}$ | 80                                                                           |               | 88    | -             |                   |          |

Note (1) Definition of Viewing Angle ( $\theta_x, \theta_y$ ):

Viewing angles are measured by Conoscope Cono-80 (or Eldim EZ-Contrast 160R)



Note (2) Definition of Contrast Ratio (CR) :

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L255}}{\text{Surface Luminance of L0}}$$

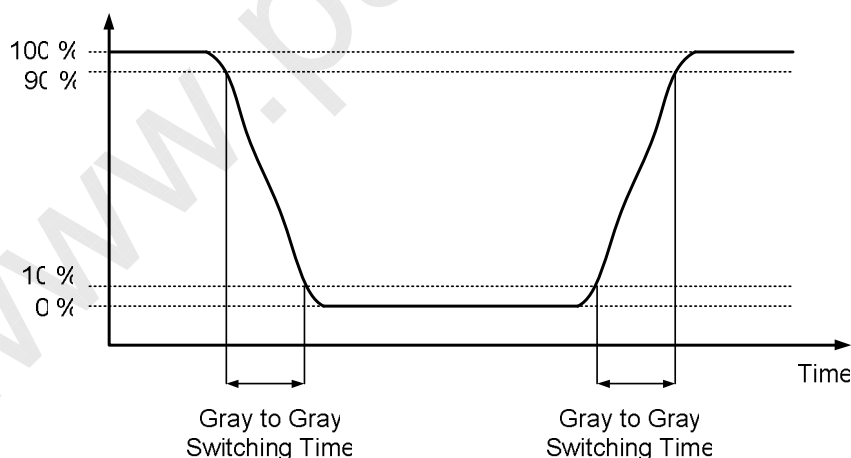
L255: Luminance of gray level 255

L0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (6).

Note (3) Definition of Gray-to-Gray Switching Time:

#### **Optical Response**



The driving signal means the signal of gray level 0, 31, 63, 95, 127, 159, 191, 223 and 255. Gray to gray average time means the average switching time of gray level 0, 31, 63, 95, 127, 159, 191, 223 and 255 to each other.

Note (4) Definition of Luminance of White ( $L_C$ ,  $L_{AVE}$ ):

Measure the luminance of gray level 255 at center point and 5 points.

$L_C = L(5)$ , where  $L(X)$  is corresponding to the luminance of the point X at the figure in Note (6).

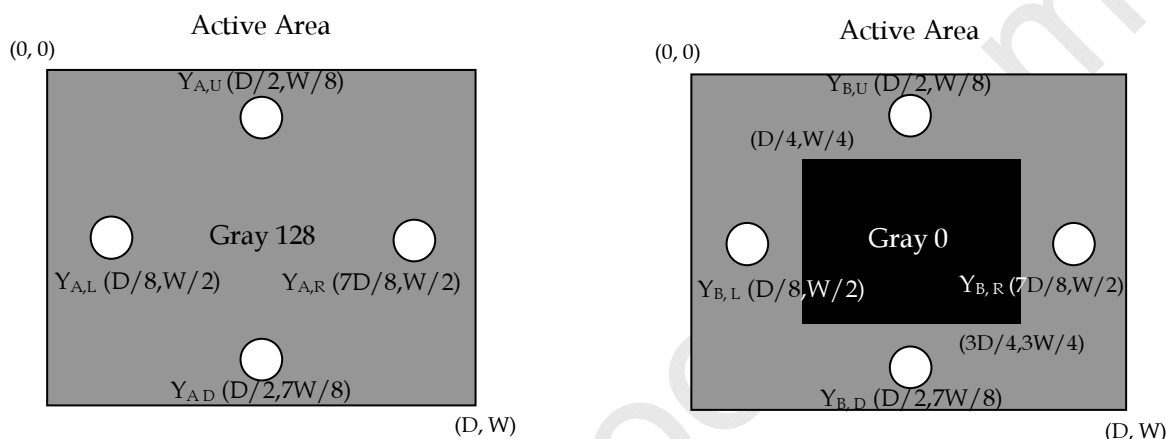
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where :

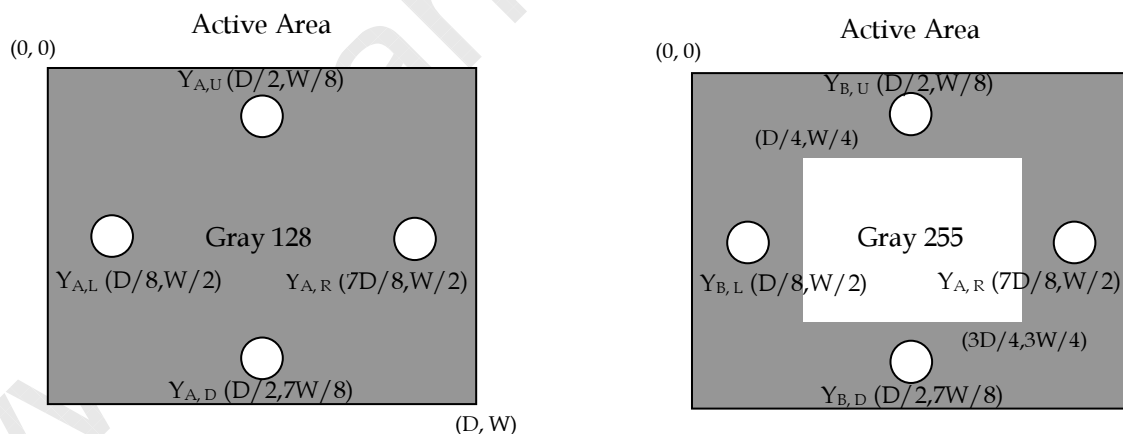
$Y_A$  = Luminance of measured location without gray level 0 pattern (cd/m<sup>2</sup>)

$Y_B$  = Luminance of measured location with gray level 0 pattern (cd/m<sup>2</sup>)



$Y_A$  = Luminance of measured location without gray level 255 pattern (cd/m<sup>2</sup>)

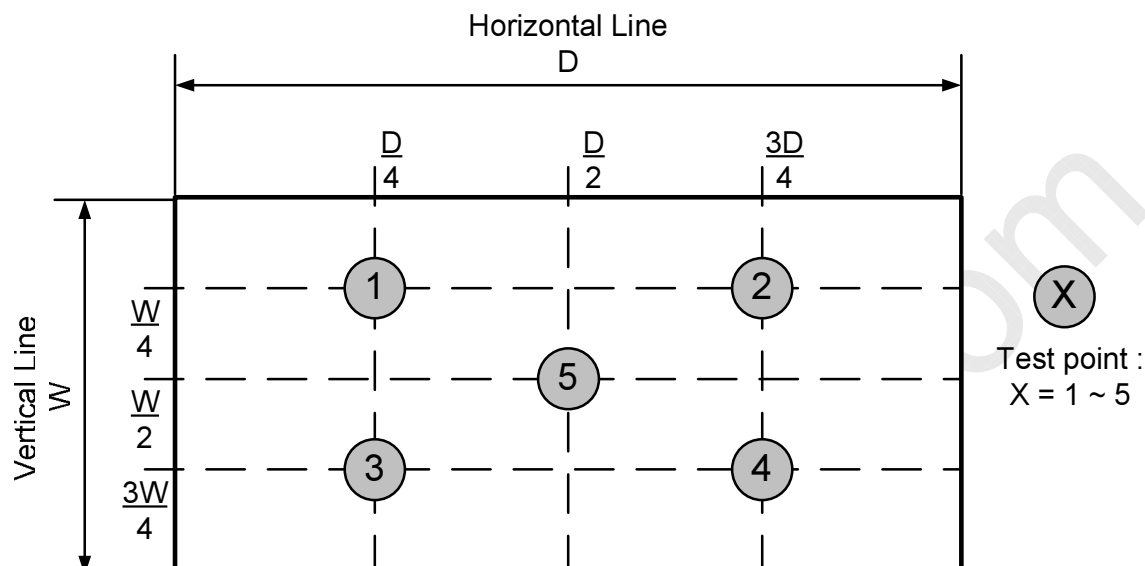
$Y_B$  = Luminance of measured location with gray level 255 pattern (cd/m<sup>2</sup>)



Note (6) Definition of White Variation ( $\delta W$ ) :

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum [L (1), L (2), L (3), L (4), L (5)]} / \text{Minimum [L (1), L (2), L (3), L (4), L (5)]}$$



## 8. PRECAUTIONS

### 8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- [ 1 ] Do not apply rough force such as bending or twisting to the module during assembly.
- [ 2 ] It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- [ 3 ] Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- [ 4 ] Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- [ 5 ] Do not plug in or pull out the I/F connector while the module is in operation.
- [ 6 ] Do not disassemble the module.
- [ 7 ] Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- [ 8 ] Moisture can easily penetrate into LCD module and may cause the damage during operation.
- [ 9 ] When storing modules as spares for a long time, the following precaution is necessary.
  - [ 9.1 ] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C at normal humidity without condensation.
  - [ 9.2 ] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.
- [ 10 ] When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

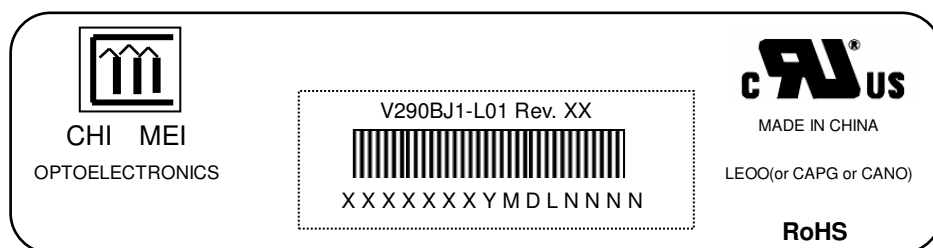
### 8.2 SAFETY PRECAUTIONS

- [ 1 ] The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.
- [ 2 ] If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- [ 3 ] After the module's end of life, it is not harmful in case of normal operation and storage.

## 9. DEFINITION OF LABELS

### 9.1 MODULE LABEL

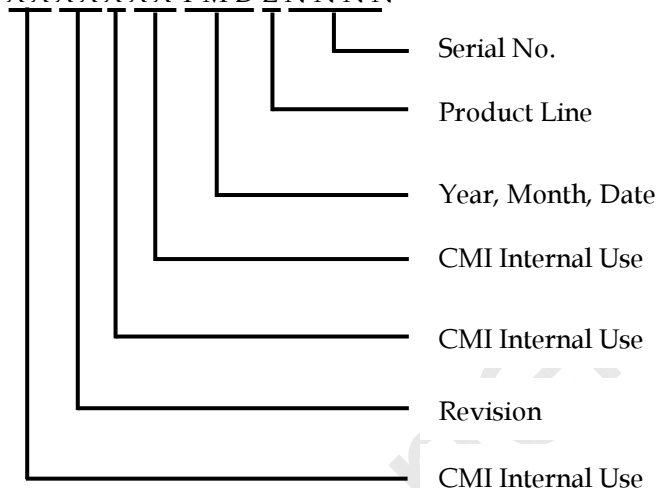
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



Model Name: V290BJ1-L01

Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below :

Manufactured Date:

Year : 2010=0, 2011=1, 2012=2...etc.

Month : 1~9, A~C, for Jan. ~ Dec.

Day : 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

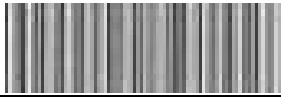
Revision Code: Cover all the change

Serial No.: Manufacturing sequence of product

Product Line: 1 → Line1, 2 → Line 2, ...etc.

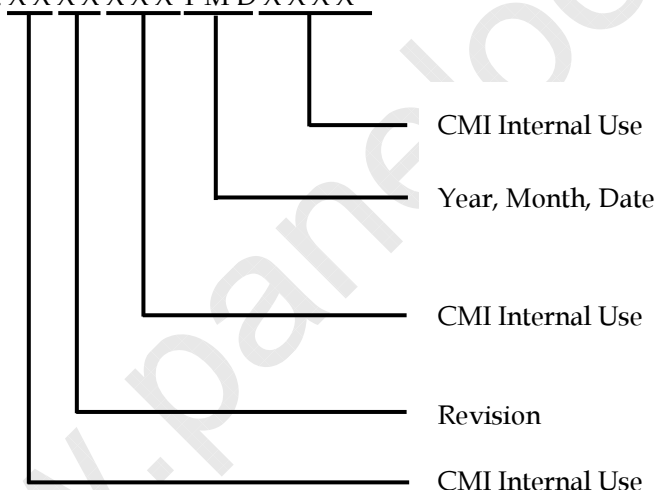
## 9.2 CARTON LABEL

The barcode nameplate is pasted on each box as illustration, and its definitions are as following explanation.

|                                |                                                                                                        |
|--------------------------------|--------------------------------------------------------------------------------------------------------|
| P.O. NO.                       | _____                                                                                                  |
| Parts ID.                      | _____                                                                                                  |
| Model Name                     | V290BJ1-L01                                                                                            |
| Carton ID.                     | <br>XXXXXXXXXXXXXXXXX |
| Quantities                     | _____                                                                                                  |
| Made In Taiwan (Made In China) |                                                                                                        |

(a) Model Name: V290BJ1- L01

(b) Carton ID: X X X X X X Y M D X X X X



Serial ID includes the information as below :

Manufactured Date:

Year: 2010=0, 2011=1, 2012=2...etc.

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

Revision Code: Cover all the change

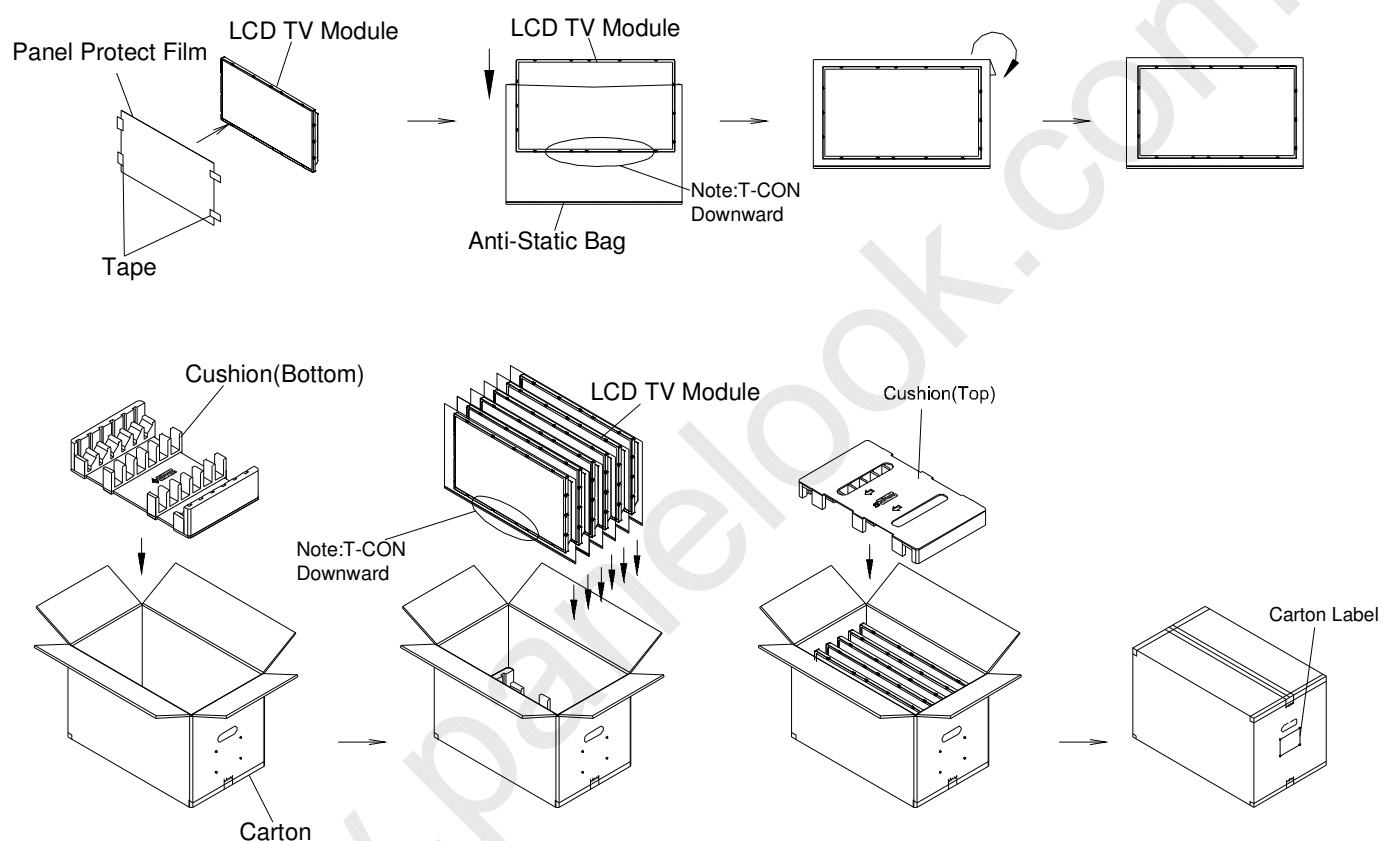
## 10. PACKAGING

### 10.1 PACKAGING SPECIFICATIONS

- (1) 6 LCD TV modules / 1 Box
- (2) Box dimensions : 713(L)x429(W)x453(H)mm
- (3) Weight : Approx. 21.5 Kg (modules per carton)

### 10.2 PACKAGING METHOD

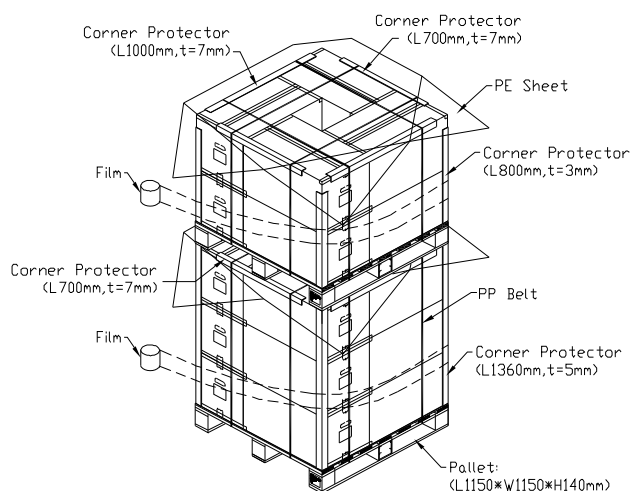
Packing methods are shown in following figures.



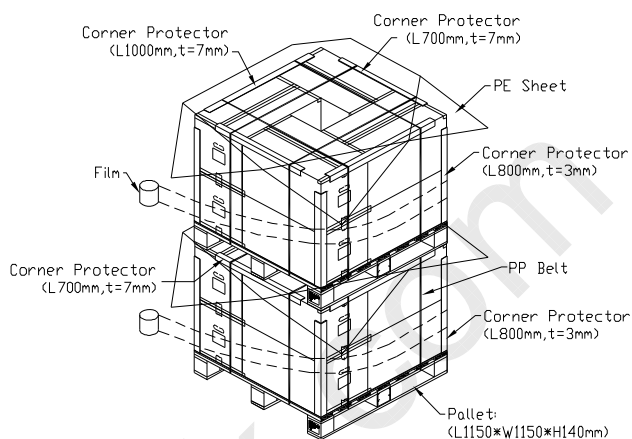




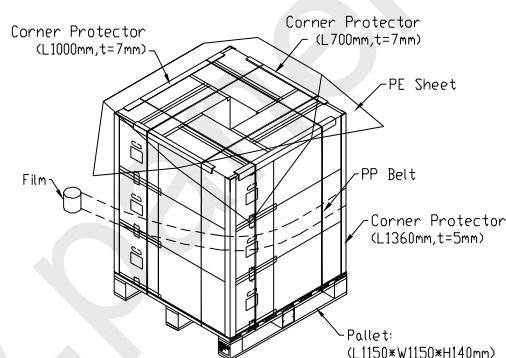
### Sea / Land Transportation (40ft HQ Container)



### Sea / Land Transportation (40ft Container)



### Air Transportation



## 11. MECHANICAL CHARACTERISTIC

